Preliminary Instruction Book

Model 112

U. H. F. Oscillator

Measurements Corp. Boonton, N.J.

MP MASTER

MA24283

U. H. F. OSCILLATOR
MODEL 112
SERIAL 117
MEASUREMENTS CORPORATION
BOONTON NEW JERSEY
MADE IN U.S.A.
FIL. CURRENT
GRID CURRENT
MEGACYCLES
FILAMENT
COARSE TUNING
OUTPUT
FINE TUNING
POWER ON
FUSE
OUTPUT

INSTRUCTION BOOK

for

MODEL 112 U.H.F. OSCILLATOR

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CHAPTER 1

INTRODUCTION

Section I

General

1. SCOPE OF MANUAL

a. This manual describes the purpose, construction, and operation of the Model 112 U.H.F. Oscillator. Following the text are two appendices. Appendix I describes the recommended procedure prior to re-shipment or prolonged storage; while Appendix II is a Table of Replaceable Parts.

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Section II

Description and Data

2. PURPOSE AND USES

a. The Model 112 U.H.F. Oscillator will provide a tunable radio-frequency carrier within the range 300 to 1000 megacycles. Although it may be used in place of a Standard Signal Generator for certain tests it is not designed to meet the requirements of a laboratory-type generator. The shielding employed in the oscillator unit is insufficient to permit measurements at low microvolt levels and the output voltage, while adjustable, is usable over a relative range of approximately 40 db.

b. The absolute output level is uncalibrated. Relative measurements of output voltage may be made, however, by means of the output dial which has a linear scale calibrated in decibels.

c. Recommended uses for the Model 112 are:

(1) Signal source for standing wave measurements on transmission lines.

(2) Signal source for antenna pattern measurements.

(3) Signal source for impedance measurements using either resonant-circuit technique, transmission-line, or ultra-high frequency impedance bridge methods.

(4) Signal source for alignment and tracking of ultra-high-frequency receivers.

3. TECHNICAL CHARACTERISTICS

a. Frequency range:	300 to 1000 megacycles.
b. Frequency calibration:	$\pm$ 0.5%.
c. Output voltage:	Maximum will vary between .3 volt and 2 volts. Adjustable over approximately 40 db range.
d. Output System:	An internal 50-ohm cable connects to a 50-ohm panel jack.
e. Power supply:	117 volts, 50/60 cycles. Input power 60 watts.

NOTE: Battery operation of the filament of the oscillator tube is recommended for maximum stability. Complete operation from an external power source is also possible when desired. Refer to schematic wiring diagram for connection details.

CAUTION!

OSCILLATOR TUBE MAY BE DAMAGED BY EXCESSIVE FILAMENT CURRENT. ALWAYS ROTATE FIL. ADJUST CONTROL FULLY COUNTER-CLOCKWISE BEFORE TURNING POWER ON AND USE NO MORE THAN 2.5

4. EQUIPMENT SUPPLIED

Quantity	Description	Dimensions H.	W.	D.	Unit Weight	Volume (cu.ft.
1	Model 112 U.H.F. Oscillator	12-3/8	13-1/8	8-1/8	22 lbs.	.77
1	Instruction Book					
1	Tube 5Y3GT, installed					
1	Tube 368AS (or 703A), installed					
1	Pilot lamp, installed					
1	fuse (1A,3AG), installed					

CHAPTER 2

OPERATING INSTRUCTIONS

Section I

Service Upon Receipt of Equipment

5. UNPACKING

a. Use particular care when unpacking the instrument to avoid damaging the instrument or marring the finish.

(1) Place the packing case in a convenient location.

(2) Remove nails with a nail puller and remove the top of the packing case.

(3) Lift the instrument from the packing case and remove covering.

(4) Inspect the instrument for possible damage during shipment.

6. INSTALLATION

a. The Model 112 is portable test equipment and requires no permanent installation. Place the instrument on the work bench and convenient to the equipment with which it will be connected. It may be operated in either the vertical or horizontal position.

b. Allow sufficient clearance between the instrument and adjacent walls or equipment to insure adequate ventilation.

Section II

Controls and Their Use

7. FIL. CURRENT

FIL.CURRENT meter indicates the filament current of the

oscillator tube. This should be adjusted to read between 4.25 and 4.4 amperes. Excessive current will shorten the life of the tube.

8. GRID CURRENT

GRID CURRENT meter indicates the rectified grid current of the oscillator tube and is intended to show only that the oscillator is operating. Normal current reading will vary between 5 and 20 milliamperes.

9. FIL. ADJUS

FIL.ADJUST potentiometer adjusts value of oscillator filament current. This knob should always be rotated fully counter-clockwise before power is turned on to prevent excessive current flowing through filament.

10. COARSE CARRIER FREQUENCY

COARSE CARRIER FREQUENCY knob provides coarse tuning of the oscillator circuit. The frequency is indicated on the scale in the window marked MEGACYCLES.

11. FINE CARRIER FREQUENCY

FINE CARRIER FREQUENCY knob provides vernier tuning of the oscillator. Incremental frequency adjustments (see note) may be facilitated by resetting the vernier dial to zero at the reference frequency. This is accomplished by pressing downward on the dial, thereby disengaging the pinion gear, and rotating it until the zero calibration is opposite the fiducial line.

NOTE: For selectivity measurements, white, celluloid rings may be obtained from Measurements Corporation that may be snapped over the calibrated dial. The center frequency and reference frequencies can be marked on the surface of the ring by the customer.

12. OUTPUT ADJUST

OUTPUT ADJUST dial controls the value of output voltage. The dial is calibrated in decibels from zero to minus 80 and may be used for relative measurement of voltage. A movable fiducial mark may be set to any desired dial calibration to establish the reference level.

13. POWER SWITCH

POWER SWITCH controls power to the primary winding of the power transformer and to the filament of the oscillator tube.

14. OUTPUT JACK

OUTPUT JACK provides means for coupling generator to load. Mating connector is AN Type [illegible] (Navy Type #49268). See Chapter 4 for list of recommended accessories.

Section III

Operation

15. PREPARATION FOR USE

a. Rotate FIL. ADJUST control fully counter-clockwise.

b. Plug power cord into a 117-volt, 50/60 cycle power line.

c. Place POWER switch in ON position and rotate FIL. ADJUST control clockwise until FIL. CURRENT meter reads between 4.25 and 4.4 amperes.

CAUTION!

DO NOT ATTEMPT TO INCREASE OUTPUT BY OPERATING FILAMENT OF OSCILLATOR TUBE AT MORE THAN 4.4 AMPERES. EXCESSIVE FILAMENT CURRENT WILL SHORTEN TUBE LIFE.

d. Allow approximately five minutes for circuits to become stabilized.

e. Check reading of GRID CURRENT meter to make certain oscillator is operating. Normal reading will vary between 5 and 20 milliamperes.

NOTE: If no reading can be obtained, check jumper connections on power plug. Refer to schematic wiring diagram for wiring details.

16. CONNECTIONS FOR OPERATION

a. Suitable cables and pads for connecting the Model 112 to equipment under test are described in Chapter 4.

b. Refer to Figure 2 for recommended methods for making connections.

17. BATTERY OPERATION OF OSCILLATOR FILAMENT

a. When maximum frequency stability is desired, the filament of the oscillator should be operated from a direct current source.

(1) Rotate FIL.ADJUST control fully counter-clockwise.

CAUTION!

DO NOT USE MORE THAN 2.5 VOLTS FOR FILAMENT SUPPLY.

(2) Remove power plug adjacent to POWER switch and replace with a plug and cable as shown on schematic wiring diagram. (D.C.SUPPLY CABLE).

b. Rotate FIL.ADJUST control clockwise until FIL.CURRENT meter reads between 4.25 and 4.4 amperes.

18. OPERATION FROM EXTERNAL POWER SUPPLY

a. The Model 112 may be operated entirely from an external

supply capable of supplying 2 volts at 4.5 amperes and 300 volts d-c at 60 milliamperes.

(1) Rotate FIL.ADJUST knob fully counter-clockwise.

(2) Replace power plug adjacent to POWER switch with plug and cable as shown on schematic wiring diagram. (EXT.POWER SUPPLY CABLE).

CAUTION!

DO NOT USE MORE THAN 2.5 VOLTS FOR FILAMENT SUPPLY.

b. Rotate FIL.ADJUST control clockwise until FIL.CURRENT meter reads between 4.25 and 4.4 amperes.

19. EXTERNAL MODULATION

a. If a modulated carrier is desired, it may be obtained by the use of auxilliary audio-frequency equipment as shown in Figure 3. Either shunt or series connection will give satisfactory results.

b. Approximate r.m.s. values of modulation voltage and equivalent modulation depth are shown in Table 1. These values are based on an oscillator plate potential of 300 volts.

TABLE 1

MODULATION VOLTAGE r.m.s.	PER CENT MODULATION
21.2	10%
42.5	20%
63.5	30%

CHAPTER 3

MAINTENANCE INSTRUCTIONS

Section I

Maintenance

20. GENERAL

a. Replacement of defective parts by the customer is not recommended. When trouble, other than tube failure is encountered, the instrument should be returned to Measurements Corporation.

b. Trouble symptoms that may be due to faulty tubes are listed in Table 2.

TABLE 2

SYMPTOM	CHECK
1. No reading on FIL.CURRENT meter	Tube V-2
2. No output. No reading on GRID CURRENT METER	Tubes V-1,V-2 Fuse F-1

NOTE: Open jumper connections in the power plug will also cause operational failures. Trouble due to failure of the internal power supply may be checked by operating the instrument from an external source.

c. Refer to Table 3, for normal operating tube voltages.

TABLE 3

21. TUBE REPLACEMENT

a. The rectifier tube, V-1, can be easily replaced after loosening the front panel screws and removing the instrument from its case. (See Figure 4)

b. When replacement of the oscillator tube is necessary proceed as follows:

(1) Remove oscillator shield.

CAUTION!

Take every precaution to prevent dirt from dropping into the oscillator assembly.

(2) Loosen screws "A" and push aside the clamps which support "Q".

(3) Loosen screws "B" and pull "Q" gently towards V-2 to separate it from its supporting mount.

(4) Note clamps"C"which secure grid and plate prongs of V-2. The tube may now be removed -- without disturbing any other screws -- by rocking it gently while pulling slowly in a direction parallel to its axis (away from oscillator base but to the left).

NOTE: After removing the tube, brush out any loose particles deposited in the cylindrical portion of the upper chamber.

(5) Loosen set screws which secure "Q" to the filament prongs of V-2 and secure it to filament prongs replacement tube in like manner.

(6) Insert plate and grid prongs of the tube into clamp "C". Locate lower pin first while it can still be seen, then align upper pin and press the tube while rocking it slightly.

CAUTION!

Forcibly seating the tube may crack the glass or cause irreparable damage to the mounting bars. If difficulty is experienced, withdraw the tube and make certain clamps "C" are exactly parallel.

(7) Replace prongs of "Q" in its mount, align clamps over "Q" and tighten screws "A" and "B".

c. Before replacing the oscillator shield, the following performance factors, affected by replacement of Tube V-2, should be checked:

(1) Parasitics: These spurious responses are most noticeable between 900 and 1000 megacycles. Their presence is indicated by a sudden jump or sharp discontinuity in grid current as the oscillator is tuned through the carrier range. The remedy for this condition is to lower the filament current. A tube requiring high filament current to sustain oscillations may tend to generate parasitic oscillations and should be rejected.

(2) Grid Current: Grid current of at least 4 milliamperes must be obtained over entire range with normal filament current.

d. Frequency calibration may be checked after an acceptable tube has been inserted and the oscillator shield can has been replaced. It is unlikely that the original frequency calibration will hold after replacement of the oscillator tube.

CHAPTER 4

EQUIPMENT USED WITH MODEL 112

22. LIST OF ACCESSORIES

PART NO.	DESCRIPTION
84-Z2-1	CABLE, co-axial, RG-8/U Nominal impedance 50 ohms; 4-ft. long, both ends terminated by Navy Type #49195 connectors.
84-Z2-2	CABLE, co-axial, RG-8/U Nominal impedance 50 ohms; 4-ft. long; one end terminates in Navy Type #49195 connector, other end in Navy Type #49268 (AN Type UG-21/U).
84-Z2-3	CABLE, electrically equivalent to part 84-Z2-2, but both ends terminated by Navy Type #49268 connectors (AN Type UG-21/U).
[illegible]	[illegible] loss. Input connector will mate with output connector of Model 112; output connector will mate with AN Type UG-21/U connector of cables 84-Z2-2 and 84-Z2-3.
80-ZH1	PAD, electrically equivalent to Part 80-ZH3, but output connector will mate with Navy Type #49195 connector of cable 84-Z2-2.

CHAPTER 5

TECHNICAL SERVICE

Section I

General

23. SCOPE

a. The purpose of this chapter is to acquaint operating personnel with the theory of operation of the circuits used in the Model 112 U. H. F. Oscillator. The customer is advised against undertaking repairs requiring parts replacement.

CAUTION!

Do NOT attempt repair of the oscillator unit. If need for repair of this unit is indicated, return the instrument to Measurements Corporation.

Section II

Theory of Operation

24. OSCILLATOR

a. A type 368AS or 703A triode is used in an original circuit. By special design of the fixed and movable elements of the tank circuit, the frequency calibration is reasonably linear.

b. The plate and grid elements of the oscillator tube, V-2, are capacitively coupled to points on the tank inductance that are 180 degrees out of phase; the filament is permitted to "float" at an intermediate phase and potential point by means of the inductance in the

filament leads. The single tuning element varies the inductance and capacitance of the tank circuit simultaneously.

c. Output voltage is controlled by means of a mutual inductance type attenuator. Coupling to the tank circuit is effected by means of a loop at one end of a co-axial cable. This loop may be moved axially within the attenuator tube by means of a rack and pinion operated by the OUTPUT ADJUST knob. Since the magnetic field is attenuated logarithmically as it passes down the attenuator tube, output voltage will vary logarithmically with rotation of the OUTPUT ADJUST knob. This characteristic permits the use of a linear decibel scale for relative voltage measurements.

d. Rectified grid current flows through GRID CURRENT meter, M-1, and indicates only that the oscillator is operating. The magnitude of the magnetic field at the entrance to the attenuator tube will not vary proportionately with the value of this current over the frequency band, and therefore, this reading cannot be referred to as indicating equal output voltage at various frequencies.

25. POWER SUPPLY

a. A conventional, full-wave rectifier supplies direct current voltage for the oscillator tube, V-2. A resistance-capacitance filter is used in place of the usual inductance-capacitance filter for removing a-c ripple.

b. Continuity of the filament and high voltage circuits is dependent upon pin wiring of the plug adjacent to the POWER switch. (Refer to Figure 1 and Schematic Wiring Diagram). It is possible, therefore, to operate the instrument partially or entirely from an external power supply. The proper pin connections for the power plug are shown on the Schematic Wiring Diagram.

APPENDIX I

STORAGE AND SHIPMENT

1. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

(1) When the use of bag and desiccant is necessary, the instrument should be checked at 6-month intervals to determine the effectiveness of the seal.

2. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least 3 inches of excelsior or similar packing material between the instrument and sides of the box.

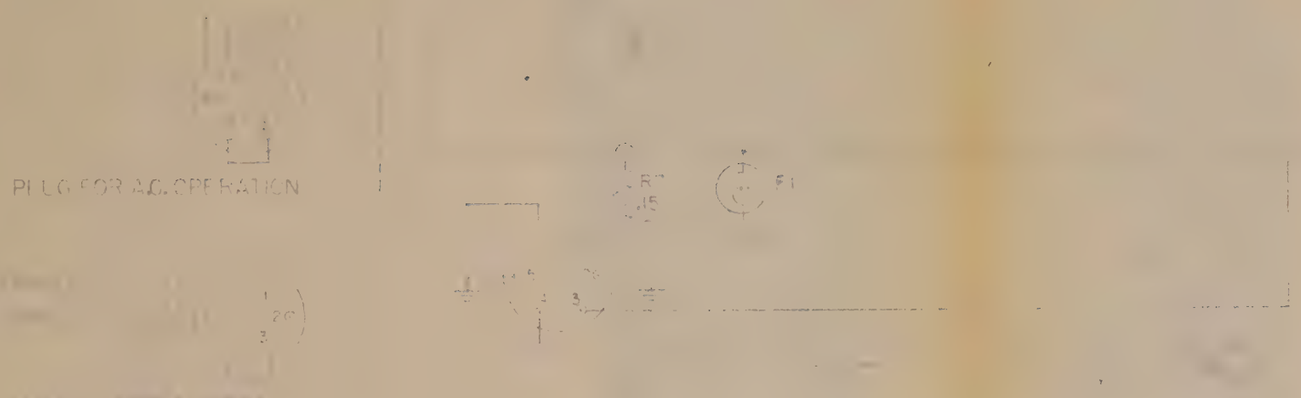
(1) For export packing the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

1. LATHING
PLASTERING

2.
PLUS

[illegible] IS FOR [illegible]
[illegible] TO 10:20 AND 30
[illegible] MODULAT [illegible] PLATE [illegible]
[illegible] VOLTS

[illegible] FOCAL [illegible] IS [illegible]
[illegible] MEANS [illegible] DETECTS
[illegible] TO MAKE CERTAIN THERE IS NO
[illegible] CURRENT MAY BE CRITICAL.



1. RESISTANCES IN OHMS
ALL RESISTORS ½ WATT
ALL CAPACITANCES IN MICRO-MICRO FARADS
UNLESS OTHERWISE SPECIFIED
K=1000

GRID
CURRENT

SCHEMATIC DIAGRAM
MODEL 112

REV.	REASON	DATE

MEASUREMENTS CORP.
BOONTON NEW JERSEY

DWN. BY	CHK. BY
SCALE	DATE

TOLERANCE
FRACTIONAL DIMENSIONS ± 010
DECIMAL DIMENSIONS ± 005
HOLES ± 002
UNLESS OTHERWISE SPECIFIED

DWG. No.

U. H. F. OSCILLATOR
Model 112

FREQUENCY RANGE: 300 TO 1000 MEGACYCLES

THE Model 112 was designed for the many applications in ultra-high frequency engineering that require a signal source having a high degree of frequency accuracy and stability.

This oscillator provides a test signal varying between 0.3 volt and 2 volts, across 50 ohms, with a frequency calibration accuracy of $\pm 0.5\%$.

The absolute output level of the instrument is uncalibrated, however an output dial, calibrated in decibels, permits the relative adjustment of output over a voltage ratio of 100 to 1.

MEASUREMENTS CORPORATION

BOONTON NEW JERSEY

U. H. F. OSCILLATOR - *Model 112*

FEATURES:

- Individually calibrated frequency dial.
- Frequency calibration accurate to ± 0.5%.
- Vernier carrier frequency control.
- Mutual inductance type attenuator.
- Output dial calibrated in decibels.
- Panel meter for indicating grid current.
- Panel meter for adjusting filament current.
- Built-in power supply.
- Power input adapter for operation from external power source.

APPLICATIONS:

- For standing wave measurements on transmission lines.
- For the measurement of antenna patterns.
- For impedance measurements using either resonant-circuit technique, transmission-line or ultra-high frequency impedance bridge methods.
- For alignment and tracking of ultra-high frequency receivers.

SPECIFICATIONS:

FREQUENCY RANGE:	300 to 1000 Megacycles.
FREQUENCY CALIBRATION:	Accurate to ± 0.5%.
OUTPUT VOLTAGE:	Maximum will vary between 0.3 volt and 2 volts. Adjustable over approximately 40 db. range.
OUTPUT IMPEDANCE:	50 ohms.
POWER SUPPLY:	117 volts; 50/60 cycles; 60 watts.
DIMENSIONS:	12½" x 13½" x 8".
WEIGHT:	22 lbs.

MEASUREMENTS CORPORATION

BOONTON NEW JERSEY

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MA24283